INSTRUCTION MANUAL

SERIES 1400

DC POWER AND BALANCE MODULE

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ORG. B–8210 M.S. 47–24
MANUAL # 18

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

NOTICE

If at any time it should become necessary to return an NLS instrument to the factory, follow the instructions contained in the Appendix of this manual (page A-1) and utilize NLS Form No. 200-50 (Shipping Notice/Packing Slip), located at the rear of the manual.

Document No. 1312
Revision A
October 1969

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Originator of the Digital Voltmeter
non-linear systems, inc.
DEL MAR (SAN DIEGO), CALIFORNIA

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SECTION I

INTRODUCTION AND SPECIFICATIONS

The NLS Series 1400 DC Power and Balance Module functions with Analog Systems and with both low and high speed Digital Data Acquisition Systems. The unit consists of an adjustable regulated power supply and signal conditioning circuits. These circuits include the following points: (1) plug-in receptacle for up to three bridge completion resistors; (2) plug-in receptacle for balance limit and calibration resistors; (3) precision 10-turn bridge balance potentiometer; (4) precision 10-turn fine voltage adjustment.

The module may be used as a single unit for bench work or for rack-mounting applications (up to eight modules may be housed in a standard 19-inch rack adapter).

An isolated power supply features all silicon semiconductors, which allow a higher operating temperature range, and all components have been derated for maximum reliability. The overall performance of the signal conditioning module provides the highest possible accuracy for test data acquisition.

The power supply excites the Wheatstone bridge which contains one or more sensitive gage elements. Pressure and strain are converted to resistance change which produces proportional change in output voltage. The analog output voltage can then be measured, displayed and recorded.

The Series 1400 has a high degree of accuracy and stability, using precision components in all critical circuit areas. In addition, it has a reserve power capability to ensure full rated output even at extreme distances.

SPECIFICATIONS
(70°F unless otherwise noted)

POWER SUPPLY

INPUT VOLTAGE:	105-130 VAC, 50-480 Hz
OUTPUT VOLTAGE:	0-25 (±1) VDC, continuously adjustable with Range Switch and a ten-turn precision potentiometer with front panel knob and knob lock. Maximum output of 24 volts at 200 milliamps is guaranteed with up to 10 ohms in both output leads.
OUTPUT VOLTAGE CONTROL RESOLUTION:	0.01% of DC output voltage or one millivolt, whichever is greater.

OPERATING MODE:	Constant voltage at the transducer, controlled by internal or remote voltage sensing. Sense mode is selected by internal DPDT switch.
OUTPUT CURRENT:	0 to 200 milliamps.
LOAD REGULATION:	0.01% of DC output voltage or 0.5 millivolts, whichever is greater (no load to full load and full load to no load) for a period of 10 minutes after each load change.
LINE REGULATION:	0.01% of DC output voltage or 0.5 millivolts, whichever is greater (105-130V line variation and 50-480 Hz) for a period of 10 minutes after each input voltage change.
OUTPUT NOISE:	Less than 100 microvolts peak-to-peak over a 10 Hz to 10 KHz bandwidth.
AC ISOLATION (Input to Output)	Less than 1 millivolt peak-to-peak noise within a 10 Hz to 200 Hz bandwidth measured across a 17.5K resistor connected between any output pins and AC line ground. AC input at 115 VRMS, 60 Hz.
OUTPUT CAPACITANCE TO GROUND:	The capacitance from any output pin to AC line ground is less than 30 picofarads.
DC ISOLATION:	10,000 megohms minimum for excitation or signal leads to AC line ground.
TEMPERATURE RANGE:	20^{o} - 140^{o}F without condensation.
TEMPERATURE STABILITY:	The temperature instability will not exceed ±0.002% of output, per degree Fahrenheit, ±80 microvolts per degree Fahrenheit, over the operating temperature range of 40^{o}F to 120^{o}F.
LINE TRANSIENTS:	Line transients within the specified range of 105-130 VAC cause no overshoot or ringing outside the regulation tolerances one millisecond or longer, after disappearance of the line transient.

VOLTAGE OVERSHOOT:	There is no transient when the power supply is turned on. The voltage rises from zero to the steady state value without exceeding the regulation specifications.
STABILITY:	The stability is better than ±0.01% of output voltage or ±0.5 millivolts, whichever is greater, for 8 hours after a 30 minute warm-up.
SHORT CIRCUIT PROTECTION:	A direct short across the power supply output, the sense leads, or the RCAL leads causes no damage and the supply assumes normal operation upon removal of the short.
VOLTAGE SENSING:	Current in the remote sense leads does not exceed 0.5 milliamperes. When the sense leads are open, the increase in power supply output is less than 3 volts.

BRIDGE BALANCE

BRIDGE BALANCE:	Initial bridge balance is provided by a balance circuit that consists of a 30,000 ohm, ten-turn precision wire-wound potentiometer. A front panel knob with knob lock controls the balance potentiometer.
BALANCE RESOLUTION:	The bridge balance potentiometer has a resolution of 0.03% or better. The range and resolution of the balance circuit is dependent on the bridge limiting resistor, which is replaceable for use of the conditioner with various transducer bridge resistances.

BRIDGE COMPLETION

BRIDGE COMPLETION:	Bridge completion is accomplished by a means of a snap-out bridge completion cell. The cell mates with a receptacle on the printed circuit board and has four gold plated, self-wiping, contacting surfaces for each point in the circuit. The cells have plastic covers with a description of the cell type attached.

BRIDGE COMPLETION (CONT):

The bridge completion cells accomplish the following:

1. Provide for one, two, or four active arms at various resistance values.

2. Select the input wiring technique from 2, 3, 4, or 5 wires to a single gage, 3 or 6 wires to a half bridge and 4, 6, 7, or 8 wires to a full bridge.

CALIBRATION

CIRCUIT CONFIGURATION:

Calibration of single strain gages and strain gage bridges can be performed with various numbers of input wires from the transducers. The number of input wires is selectable through the use of various types of bridge completion cells. The shunt calibration is performed on the opposite side of the bridge from the bridge balance circuit.

SHUNT CALIBRATION:

One step plus and one step minus shunt calibration is available.

CALIBRATION CONTROL:

Selection of the desired calibration step may be accomplished either manually or remotely. Manual calibration is performed by actuating the the momentary action toggle switch located on the front panel. Either plus or minus calibration may be obtained. Remote calibration is accomplished by completing the proper relay power circuit and thereby energizing the plus or minus calibration relay. See Drawing 14-125, sheet 2.

SHIELDING:

The input signal is carried into the module and connected to the guard shield. The guard shield encloses all of the circuitry but is completely isolated from the module chassis. The transformers' overall secondary electrostatic shield is connected to the guard shield and actually provides the guard shields' reference potential; thus, the module has a driven guard. The output signal shield is also connected to the guard shield.

SECTION II

INSTALLATION AND OPERATION

UNPACKING

The instrument is shipped in a heavy cardboard container. Cut the tape on the top of the container and open. If damage is observed, promptly notify the carrier. Immediately check the packing slip for possibility of shortages.

POWER SOURCE

The unit is supplied for operation from 105 - 130 volt, 50 - 480 Hz, single phase power sources.

CONNECTIONS

A single connector (J1), located on the rear of the module, provides pins for connection of power input, remote input and signal output. (See Drawing No. 14-125, sheet 2 for connection information.)

CONTROLS (Figure 2-1)

POWER

The module has a pushbutton power on-off switch with a red pilot light.

EXCITATION VOLTAGE ADJUSTMENT (EXC)

The front panel potentiometer for voltage adjustment has a knob and a knob lock.

RANGE SWITCH

An eight-position front panel switch varies the excitation voltage from 0 to 24 volts in approximately four-volt steps. Combination of range switch and EXC potentiometer allow continuous EXC adjustment from 0 to 24 volts.

BRIDGE BALANCE (BR BAL)

The front panel potentiometer for bridge balancing has a knob and a knob lock.

SIGNAL OUTPUT SWITCH (SIG)

The signal output switch has three positions:

Figure 2-1. Front View

1. MON. A momentary action position which applies the conditioned bridge output signal to separate connector pins for monitoring purposes.

2. OUT. A continuous action position which applies the conditioned bridge output signal to separate connector pins for use as a "second" output for driving galvanometers, etc.

3. OFF. The center position of the switch disconnects both outputs.

VOLTAGE EXCITATION MONITOR (EXC MON)

The excitation monitor switch has two positions:

1. PS MON. This position applies the power supply excitation voltage to a pair of connector pins for monitoring purposes.

2. BR MON. This position applies the voltage on the bridge to a pair of connector pins for monitoring purposes.

SENSE

The sense switch is an internally mounted, two position toggle switch (S5, Figure 5-1) which provides selection of either internal (INT) or remote (REM) sensing.

CALIBRATION SELECTION (CAL)

Fixed calibration steps are selected by this front panel momentary toggle switch (either "+" or "-") or by energizing relays within the module.

MODULE REMOVAL

The module is removable from the front (if rack mounted) for ease in changing the bridge completion and calibration cell. Male, blue-ribbon type connectors on the module mate with female connectors in the rear of the rack adapters. This facilitates adjustment, maintenance, or single channel replacement should this be necessary.

BRIDGE COMPLETION CELL - GENERAL

Module versatility in input wiring techniques is gained through an easily changed, modular bridge completion cell. The power and balance module is designed to be used with any type of input wiring technique, up to and including eight wires to a full bridge transducer and five wires to a single strain gage. The cell receptacle on the printed circuit board has four gold-plated, self-wiping contacting surfaces for each contact point in the circuit. This eliminates contact resistance problems encountered with other techniques.

BRIDGE COMPLETION CELLS

Snap-out cells to facilitate strain gage use with various wiring configurations are available. The bridge completion wiring diagrams are shown in Drawing No. 14-157. A total of eight different bridge completion cells are available for operation as follows:

SINGLE ACTIVE GAGE

1. Part No. P104-15-XX. Five-wire technique, which gives three primary advantages:

   a. Temperature compensation through a three-wire circuit that eliminates thermal zero shift caused by lead wire resistance change.

   b. Negative shunt calibration through two separate wires to the strain gage.

   c. Positive shunt calibration directly across the bridge completion resistor, R4 (see Dwg. No. 14-157).

2. Part No. P104-14-XX. Four-wire technique, which had advantages (b) and (c) above.

3. Part No. P104-13-XX. Three-wire technique, which has advantage (a) above.

4. Part No. P104-12-XX. Two-wire technique.

TWO ACTIVE GAGES - HALF BRIDGE

1. Part No. P104-26-XX. Six-wire technique, which has advantages (a) and (b) above plus positive shunt calibration across active arm R4 (see Dwg. #14-158) through two separate wires.

2. Part No. P104-23-XX. Three-wire technique.

FOUR ACTIVE GAGES - FULL BRIDGE

1. Part No. P104-48-00. Eight-wire technique, with inherent temperature compensation and positive and negative shunt calibration through three separate wires.

2. Part No. P104-44-00. Four-wire technique.

BRIDGE COMPLETION CELL IDENTIFICATION

P104 - X X - XX

- XX: Gage Resistance in ohms Divided by 10
- X: Number of Wires to Gage
- X: Number of Gages
- P104: Bridge Completion Cell

For example, a P104-12-12 cell would be described as follows:

P104 - 1 2 - 12

- 12: 120 ohm Gage Resistance
- 2: Two Wires to the Gage
- 1: One Strain Gage
- P104: Bridge Completion Cell

REMOTE SENSING

Two additional wires for remote sensing may be programmed by placing the internal sense switch in REM (S5, Figure 5-1). Connections must then be made at the transducer as shown by the dotted lines on Drawing No. 14-158. This remote sensing capability is available with all bridge wiring.configurations.

CALIBRATION/LIMITING RESISTOR CELLS

The calibration cell used in the one-step shunt calibration system includes the limiting resistor for the bridge balance control. This cell is of the same type used for bridge completion. It eliminates costly, time consuming soldering operations required to change the calibration and bridge limiting resistors.

CALIBRATION CELL IDENTIFICATION

P202 XX YY

- YY: Bridge Balance Limit Resistor in K ohms
- XX: Calibration Resistor in K ohms
- P202: Calibration Cell

For example a P202-55-30 cell would be described as follows:

P202 55 30

- 30: Bridge Balance Limit Resistor is 30 K ohm
- 55: Calibration Resistor Value is 55K ohm
- P202: Calibration Cell

CALIBRATION

The DC Power and Balance Module may be calibrated either manually or remotely. Manual calibration is accomplished by actuating the front panel mounted momentary action toggle switch. Remote calibration is effected by the application of a nominal 24 VDC to either of two internal relays (K1 for "-" and K2 for "+", see Figure 5-1 and Drawing No. 14-125, sheet 2).

SECTION III

THEORY OF OPERATION

POWER SUPPLY (See Figure 3-1)

TRANSFORMER

The high isolation of the DC Power and Balance Module power supply is accomplished with the use of a well shielded torrodial transformer. This transformer has a primary winding, two secondary windings, and utilizes four internal electrostatic shields.

RECTIFIER AND FILTER

Secondary No. 1 is converted to two DC voltages by half-wave bridge rectifiers and capacitor filters. The plus voltage operates the reference supply. Secondary No. 2 is converted to DC by a full-wave bridge rectifier and a capacitor filter. This resulting DC voltage drives the series regulator.

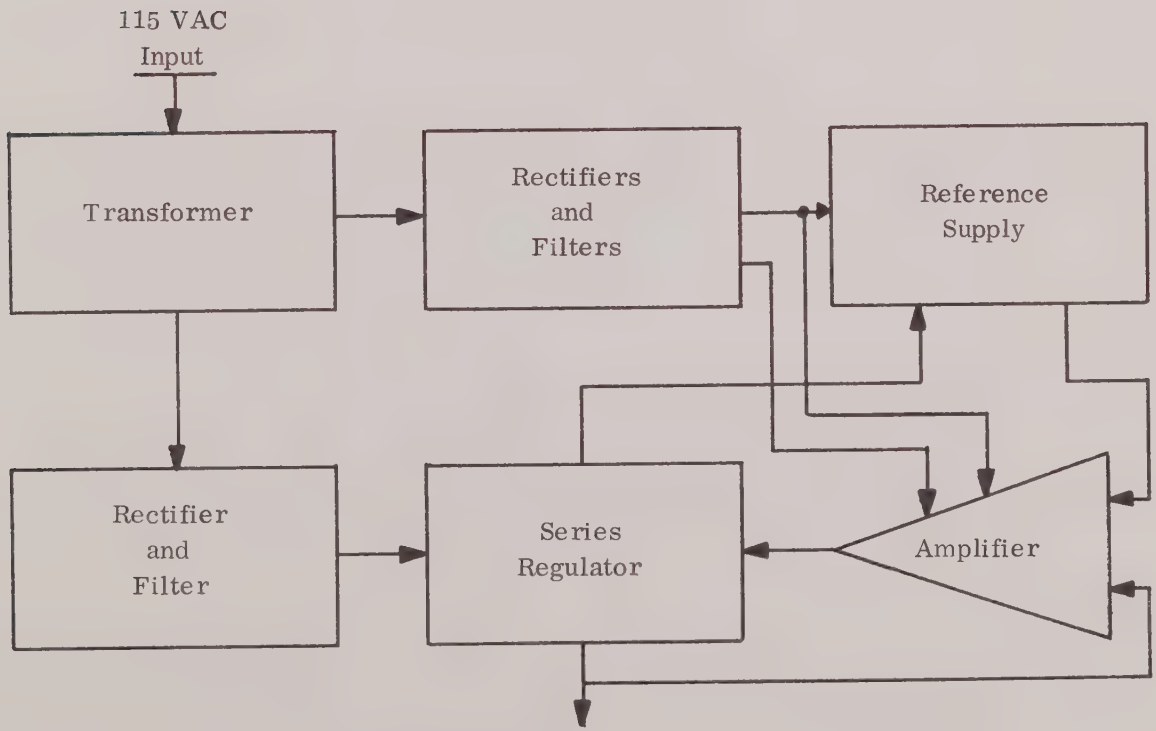


Figure 3-1. Power Supply Block Diagram

REFERENCE SUPPLY

A preregulator is driven by the plus rectifier output of Secondary No. 1. The output of the preregulator drives a stable constant current source which supplies current to a temperature compensated zener diode.

AMPLIFIER

The power supply amplifier consists of a high performance integrated circuit operational amplifier driven by two regulated supplies.

SERIES REGULATOR

The output of the amplifier drives a three-stage series regulator. Following the series regulator there is a 10-ohm resistor used as a current sensor to provide a signal to the current limiting circuit.

REMOTE SENSE

The voltage sensing line is a constant current feedback loop of nominally 0.5 milliamperes. This current is the input to the amplifier which controls the power supply output voltage.

SIGNAL CONDITIONING

BRIDGE BALANCE

The Power and Balance module uses a T-balance network with the ends of the potentiometer connected between the positive and negative excitation (points A & D on the bridge). The wiper of the bridge balance potentiometer is connected through the limiting resistor to the negative bridge output (C).

CALIBRATION

The bi-polar shunt calibration is connected across the two arms of the bridge opposite the bridge balance. For positive calibration, the shunting resistor is connected between the positive bridge output (B) and the positive bridge excitation (A). For negative calibration, the shunting resistor is connected between the positive bridge output (B) and the negative bridge excitation (D).

CALIBRATION CONTROL

Remote calibration control is accomplished by two printed circuit board mounted relays. One relay is for plus calibration, and one is for minus. Remote calibration is accomplished by energizing the relays through connector pins at the rear of the module. In the manual calibration mode, the calibration resistor is applied to the proper arms of the bridge by a momentary action toggle switch. The switch contacts and the relay contacts are in parallel.

SIGNAL OUTPUT SWITCH

The signal output switch provides two outputs from the module in addition to the primary output. These outputs are in parallel to the primary output, and either a continuous or momentary output signal may be chosen. The switch has a center "OFF" position.

VOLTAGE EXCITATION MONITOR SWITCH

The voltage excitation monitor switch provides for a monitor of the power supply voltage and the bridge voltage.

SECTION IV

MAINTENANCE AND CALIBRATION

MAINTENANCE

The DC Power and Balance Module features solid-state circuitry. No routine maintenance such as tube checking and replacement is required. Any component may be replaced without effecting performance of the unit with the exception of Zener Diode CR13, and associated resistor R21,located on the power supply board; replacement of CR13 and R21 should be accomplished at the factory. Refer to Table I for trouble-shooting information.

CALIBRATION

Calibration, other than that described in Section II, is not required.

TABLE I. Troubleshooting Guide

Problem	Remedy
SIGNAL CONDITIONING SECTION	
No Output	Check for 115 VAC input. Check for proper mating of AC power connectors. Make sure bridge input connectors are installed properly. Check for shorted transducer. Check for excitation voltage.
High Output	Output approximately 1/2 of excitation voltage: Check for open bridge.
No Output in Calibration Mode	Check for shorted calibration lead. Check for operation of relays.
Improper Output in Calibration Mode	Check for proper calibration resistor. Check calibration selector switch contacts. Check bridge excitation voltage. Check relay power application and relays.
Inability to Balance Bridge	Check for open bridge. Check for improper completion cell.
Zero Shift	Check all connector contacts for proper mating.
No Bridge Excitation	See below.
POWER SUPPLY SECTION	
No Output	Check for 115 VAC at module connector. Check for shorted output. Check for voltage across C12.
High Output Voltage	Check sense leads for proper connection. Check for shorted Q1, 2 or 3.

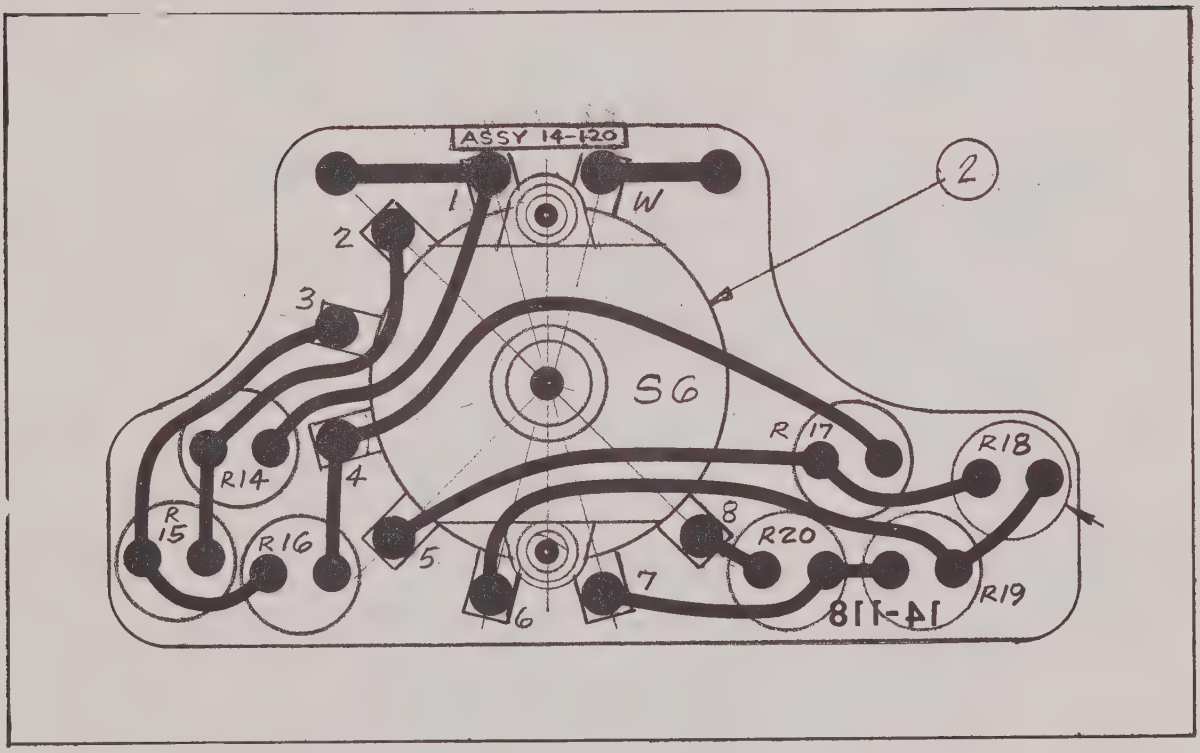


Figure 4-1. Range Board Printed Circuitry

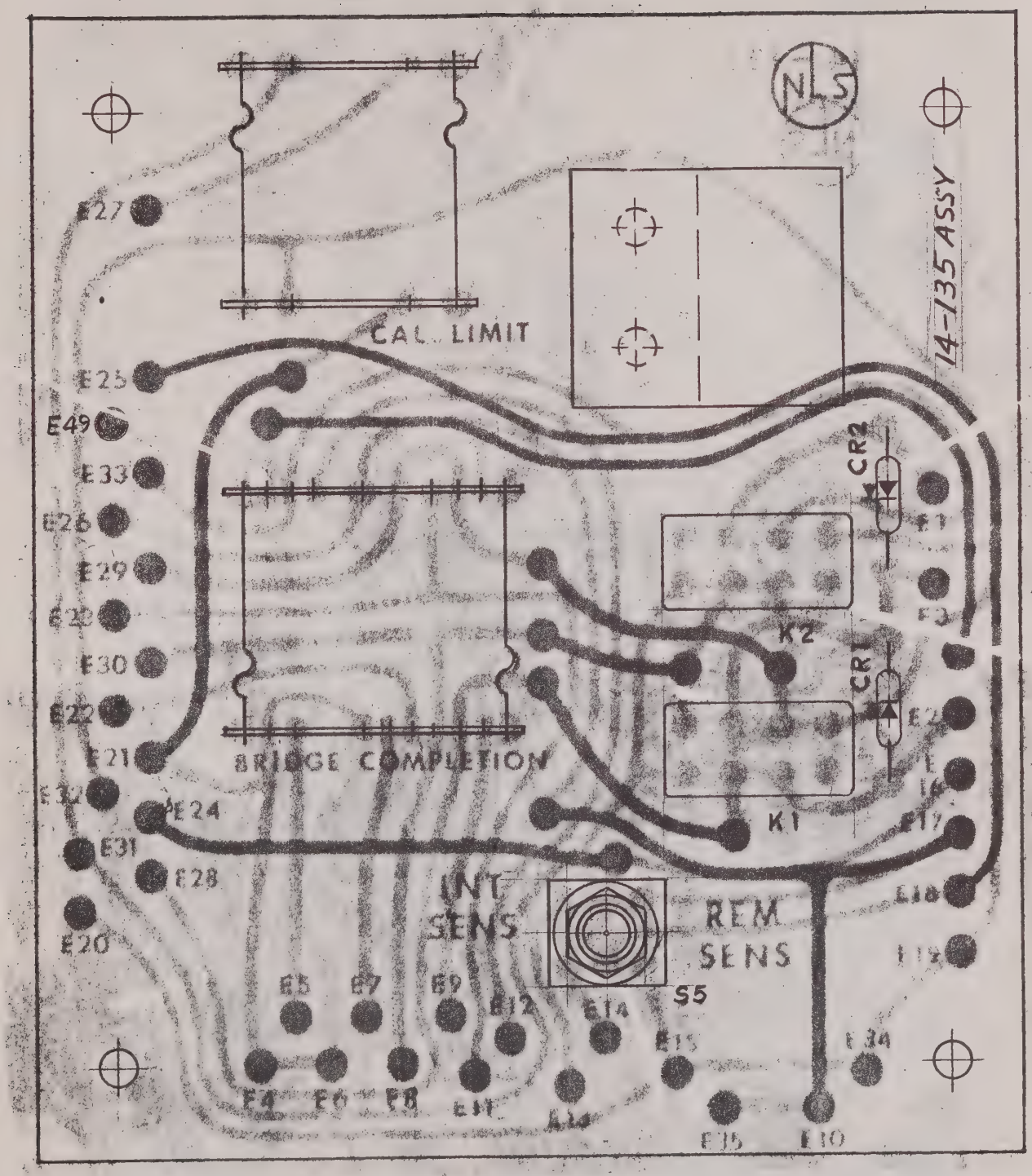


Figure 4-2. Signal Conditioner Board Printed Circuitry

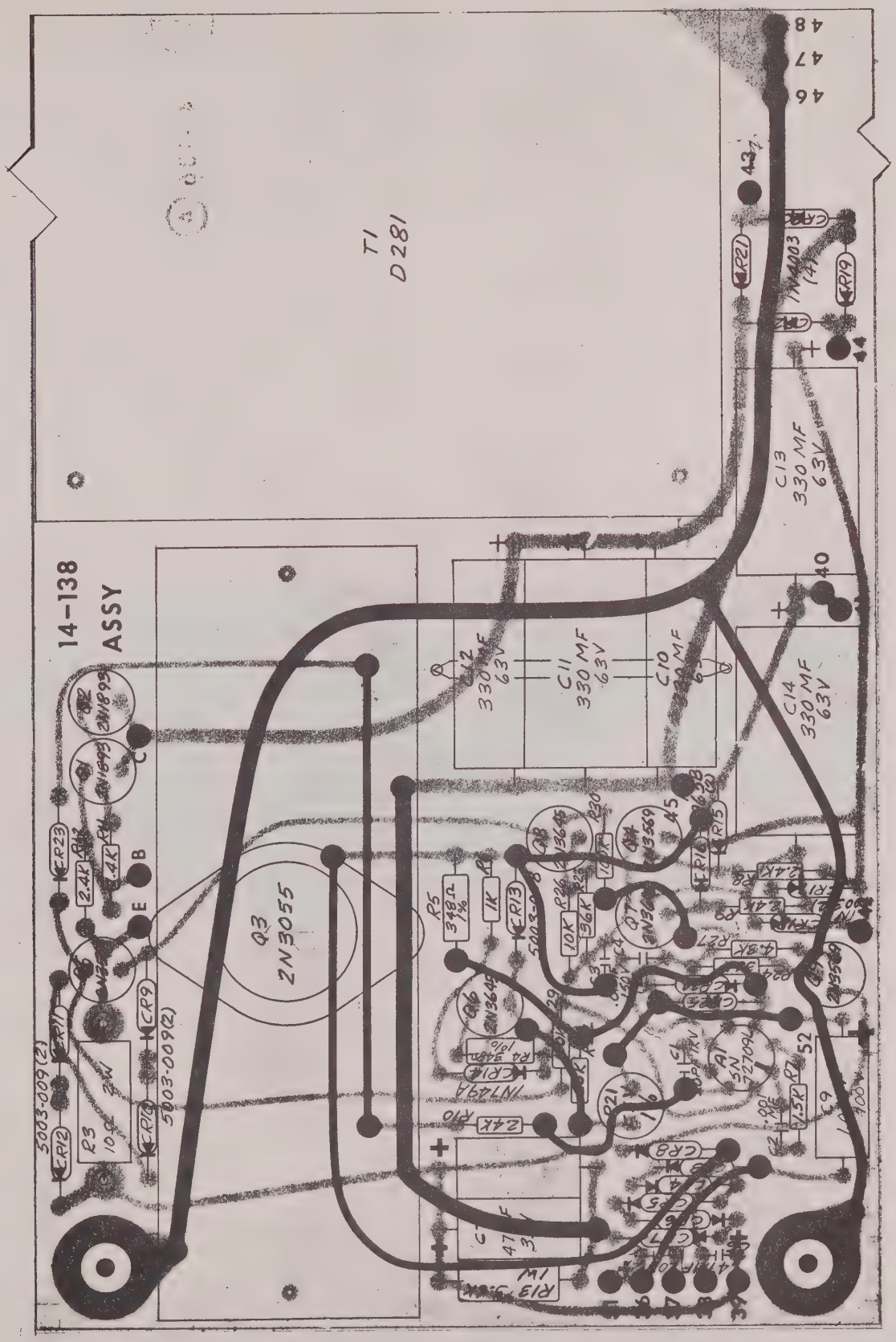


Figure 4-3. Power Supply Board Printed Circuitry

SECTION V

PARTS LIST

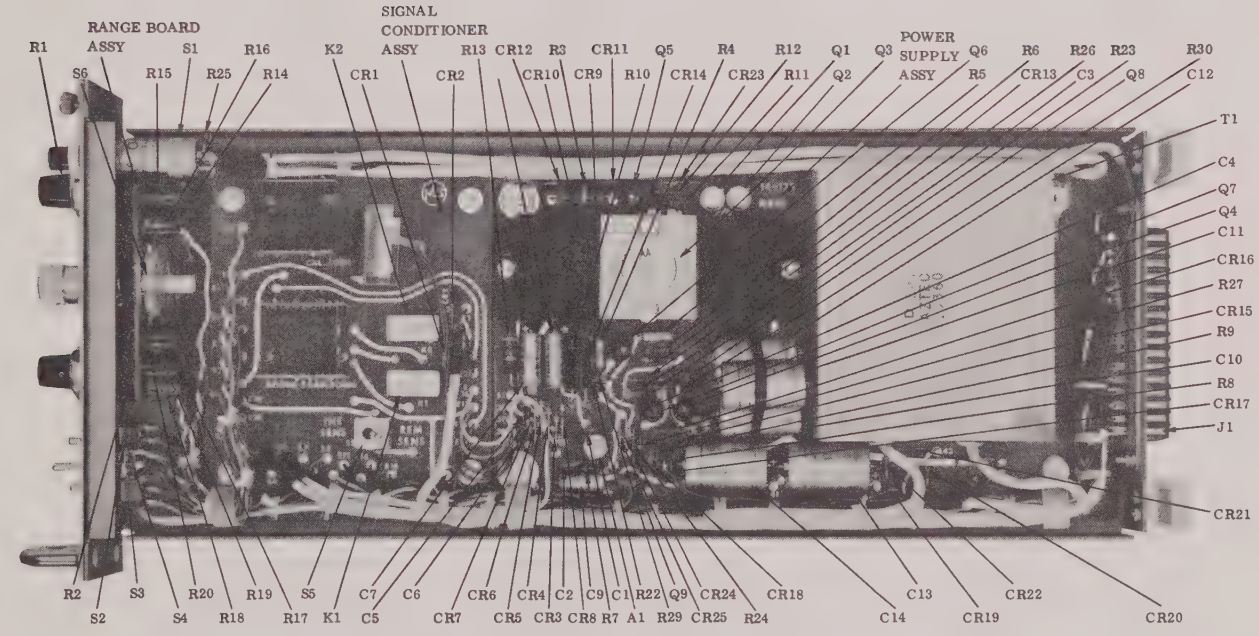


Figure 5-1. DC Power and Balance Module

CIRCUIT REFERENCE	PART NO.	DESCRIPTION	QTY PER ASSY	MFR'S CODE
A1	SN72709L	AMPLIFIER	1	49956
C1	DD200	CAPACITOR, 20 PF, 1 KV	1	71590
C2	DD102	CAPACITOR, 0.001 MF	1	71590
C3 & C4	DDM103	CAPACITOR, 0.01 MF, 150V	2	71590
C5 & C6	TSD1-20-474	CAPACITOR, 0.47 MF, 20V	2	18641
C7	STA 826-1	CAPACITOR, 47 MF, 35V	1	18641
C9	212AB105M	CAPACITOR, 1.0 MF, 100V	1	14752
C10 thru C14	2222-027-18391	CAPACITOR, 330 MF, 63V	5	73445
CR1 thru CR8 & CR23 thru CR25	5003-002	DIODE	11	03626
CR9 thru CR12	5003-009	DIODE	4	03626
CR13	5003-008	DIODE, ZENER, 6.2V, 5%	1	03626
CR14	1N749A	DIODE, ZENER, 4.3V, 5%	1	04713
CR15 & CR16	1N963B	DIODE, ZENER, 12V, 5%	2	04713
CR17 thru CR22	1N4003	DIODE	6	01295
J1	26-1400-32P	CONNECTOR	1	02660
K1 & K2	BR26-700A1-26	RELAY	2	09026
Q1 & Q2	2N1893	TRANSISTOR	2	01295
Q3	2N3055	TRANSISTOR	1	04713
Q4, Q5 & Q9	2N3569	TRANSISTOR	3	07263
Q6 thru Q8	2N3645	TRANSISTOR	3	07263
R1	14-121	POTENTIOMETER, 10K	1	03626
R2	14-122	POTENTIOMETER, 30K	1	03626
R3	RC42GF100J	RESISTOR, 10 Ohms, 2W, 5%	1	
R4 & R5	RN60D3480F	RESISTOR, 348 Ohms, ¼W, 1%	2	
R6	RC07GF102J	RESISTOR, 1K, ¼W, 5%	1	
R7	RC07GF152J	RESISTOR, 1.5K, ¼W, 5%	1	
R8 thru R12	RC07GF242J	RESISTOR, 2.4K, ¼W, 5%	5	
R13	RC32GF362J	RESISTOR, 3.6K, 1W, 5%	1	
R14 thru R20	PW1216	RESISTOR, 7.5K, ¼W, 1%	7	03626
R21	PW1216	RESISTOR, 15-16K*, 1%	1	03626
R22	RC07GF203J	RESISTOR, 20K, ¼W, 5%	1	
R23 & R24	RC07GF363J	RESISTOR, 36K, ¼W, 5%	2	
R25	RC07GF273J	RESISTOR, 27K, ¼W, 5%	1	
R26	RC07GF103J	RESISTOR, 10K, ¼W, 5%	1	
R27	RC07GF432J	RESISTOR, 4.3K, ¼W, 5%	1	
R29 & R30	RC07GF104J	RESISTOR, 100K, ¼W, 5%	2	
S1	616-6-1-A1H	SWITCH, INDICATOR	1	76854
S2	MST-205T	SWITCH	1	95146
S3 & S4	MST -205S	SWITCH	2	95146
S5	MSTE-206N	SWITCH, DPDT	1	95146
S6	14-139	SWITCH ASSEMBLY, RANGE	1	03626
T1	D281	TRANSFORMER	1	03626

*Factory Selected Value

SECTION VI

RECOMMENDED SPARE PARTS

Part No.	Title	Qty.
SN72709L	Amplifier	1
TSD1-20-474	Capacitor 0.47 μf, 20V	2
STA 826-1	Capacitor 47 μf, 35V	2
69F26167	Capacitor 47 μf, 50V	1
2222-027-18391	Capacitor 47 μf, 63V	3
26-4100-32P	Connector, 32 Pin	1
1-85306-6	Contacts, Rib	5
2606	Dial, Turns Counting	2
1N4003	Diode	4
5003-002	Diode	6
51-18-406-24	Fastener Assy	1
07-10-101-11	Latch	2
14-121	Potentiometer, 10K, WW	1
14-122	Potentiometer, 30K, WW	1
BR26-700A1-26	Relay	2
PW1216	Resistor, 7.5K, 1/4W, 1% (NLS)	7
RC42GF100J	Resistor, 10μ, 1/2W, 5%	1
9904-C	Screws, Nylon 4-40 x 3/4	2
MST-205S	Switch, Cal/Mon	2
MSTE-206N	Switch, DPDT	1
616-6-1-A1H	Switch, Power	1
14-139	Switch, Range	1
MST-205T	Switch, Signal	1
D-281	Transformer	1
2N1893	Transistor	2
2N3055	Transistor	1
2N3569	Transistor	3
2N3645	Transistor	3
T201	Wafer Switch, Shorting CTS S6	1
1N749A	Zener, 4.3 V, 5%	1
1N963B	Zener, 12V, 5%	2

APPENDIX

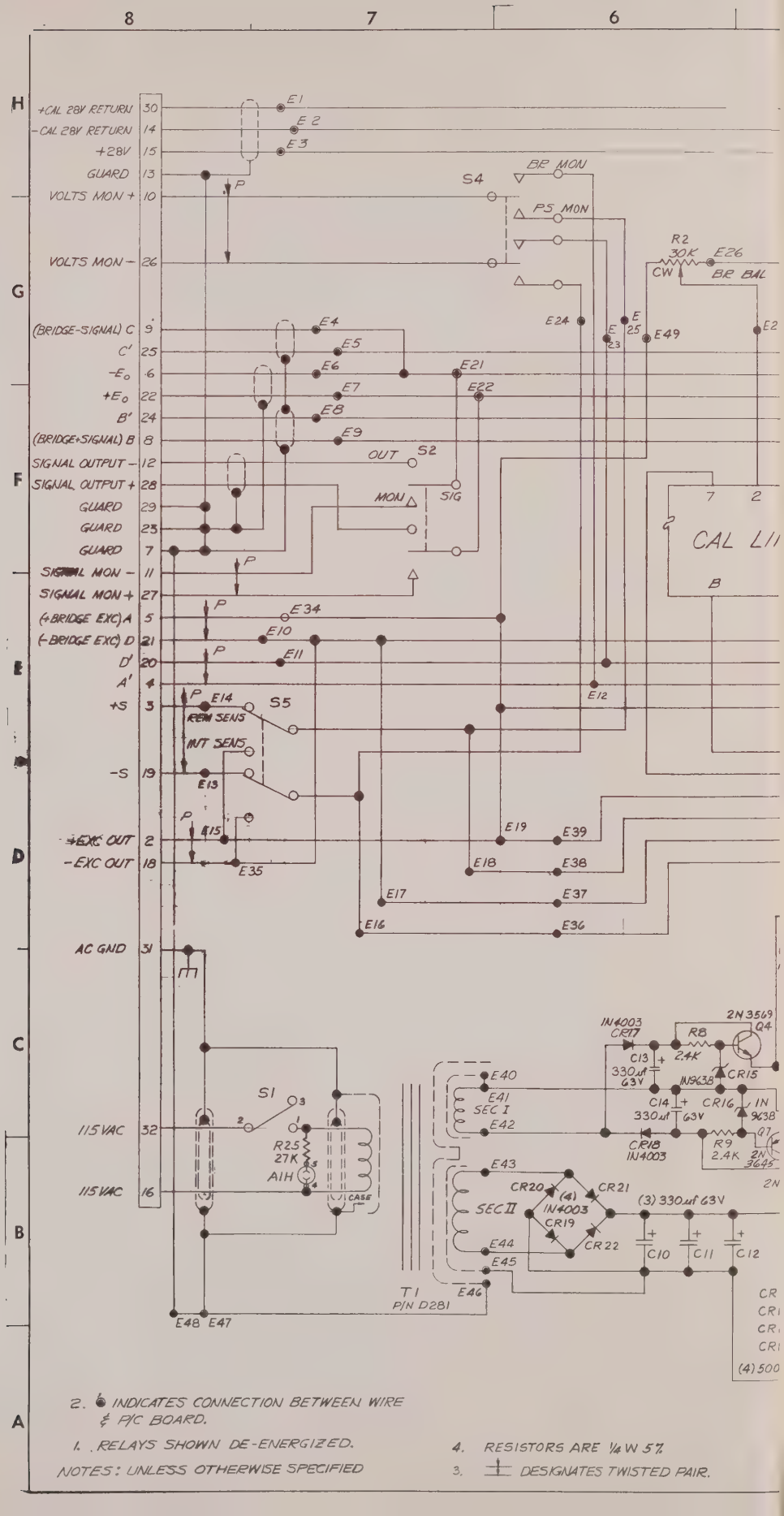
SHIPPING INSTRUCTIONS

Depending upon location, the choice of carrier will vary. Never ship an instrument to us without having received shipping instructions. If requested, an estimate of charges can be made before work begins.

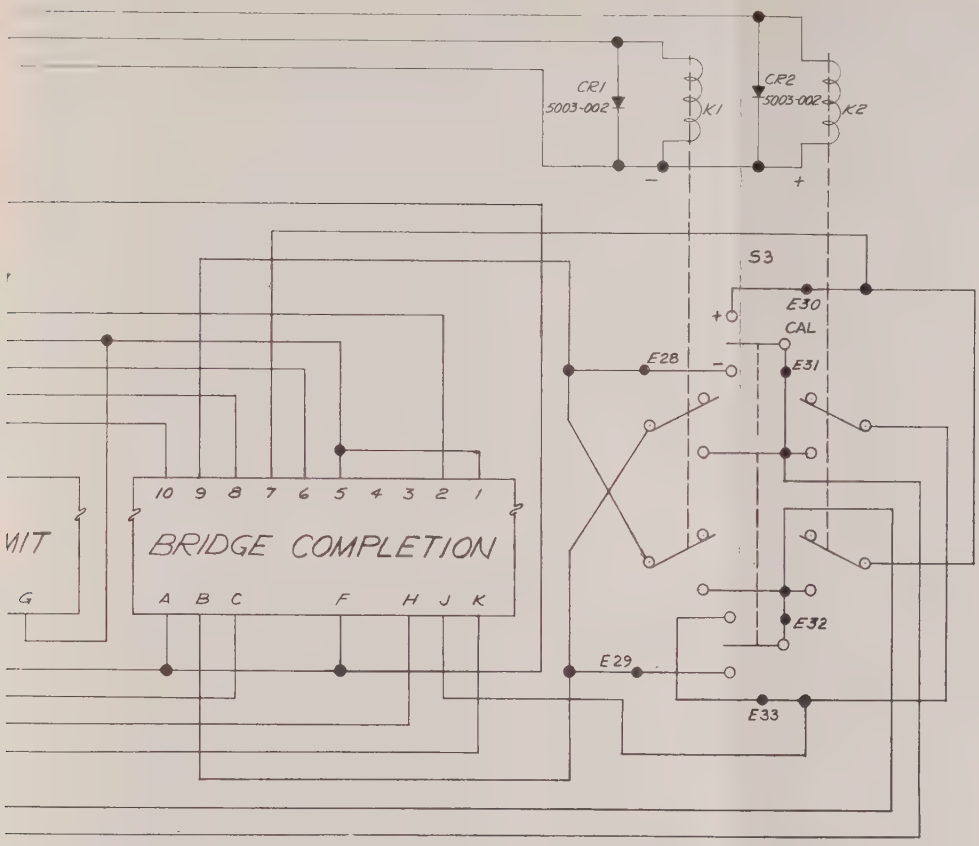
Be certain to pack the instrument carefully; while an outer and inner box, separated by two or three inches of excelsior is desirable, the instrument can be placed into a single container provided it is so packed that it will not shift about. As with the double box method, use two or three inches of shock-absorbent packing materials. The instrument itself should be first wrapped in heavy paper so as to keep excelsior or other particles from entering the instrument's louvers. If the original shipping container is in good condition, it may be used.

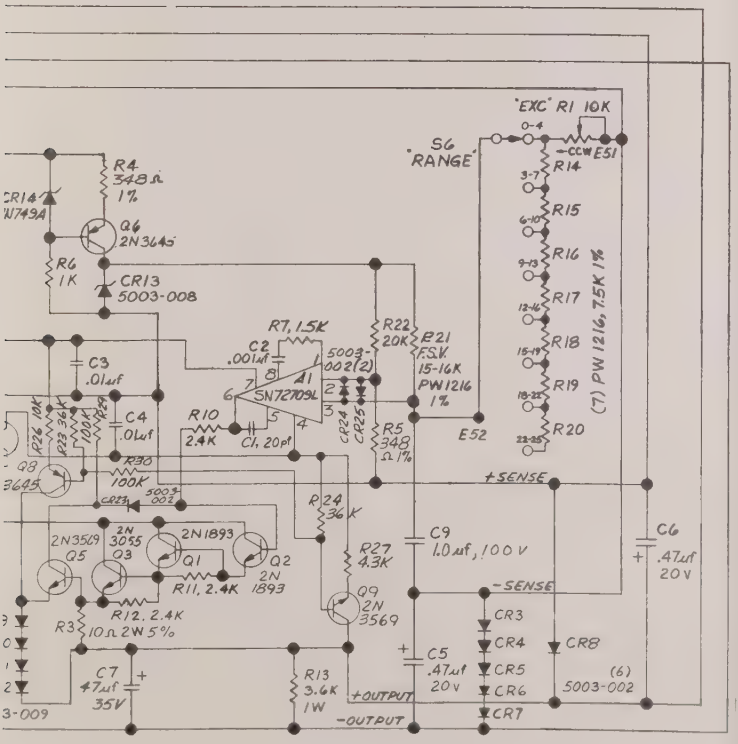
CLAIM FOR DAMAGE IN SHIPMENT

The instrument should be tested as soon as it is received. If it does not operate or is damaged, a claim should be made with the carrier. The claim agent should receive a full report of damage, and this report sent to Non-Linear Systems, Inc. After receiving such a report we will advise you of the disposition of the instrument and arrange for its repair or replacement. Be certain to include model and serial number when corresponding.


8
7
6
H
G
F
E
D
C
B
A
+CAL 28V RETURN 30
-CAL 28V RETURN 14
+28V 15
GUARD 13
VOLTS MON + 10
VOLTS MON - 26
(BRIDGE-SIGNAL) C 9
C' 25
-Eo 6
+Eo 22
B' 24
(BRIDGE+SIGNAL) B 8
SIGNAL OUTPUT - 12
SIGNAL OUTPUT + 28
GUARD 29
GUARD 23
GUARD 7
SIGNAL MON - 11
SIGNAL MON + 27
(+BRIDGE EXC) A 5
(-BRIDGE EXC) D 21
D' 20
A' 4
+S 3
-S 19
+EXC OUT 2
-EXC OUT 18
AC GND 31
115 VAC 32
115 VAC 16
E1
E2
E3
E4
E5
E6
E7
E8
E9
E10
E11
E12
E13
E14
E15
E16
E17
E18
E19
E21
E22
E23
E24
E25
E26
E34
E35
E36
E37
E38
E39
E40
E41
E42
E43
E44
E45
E46
E47
E48
E49
P
S1
S2
S4
S5
BR MON
PS MON
OUT
SIG
MON
REM SENS
INT SENS
R2 30K
CW
BR BAL
R25 27K
A1H
CASE
CAL L11
T1 P/N D281
SEC I
SEC II
(4) IN4003
CR17
CR18
CR19
CR20
CR21
CR22
C13 330uf 63V
C14 330uf 63V
(3) 330uf 63V
C10
C11
C12
R8 2.4K
R9 2.4K
CR15
CR16
IN 963B
2N3569 Q4
Q7
2N 3645
(4) 500
2. ⏚ INDICATES CONNECTION BETWEEN WIRE & P/C BOARD.
1. RELAYS SHOWN DE-ENERGIZED.
NOTES: UNLESS OTHERWISE SPECIFIED
4. RESISTORS ARE 1/4 W 5%
3. ⊥ DESIGNATES TWISTED PAIR.

REVISIONS					
ZONE	LTR	EFFECT.	DESCRIPTION	DATE	APPROVED
6G	A	ALL	REVERSED CONNECTIONS AT S4	2-3-68	R.B.
A5/6G	B	ALL	DELETED CB; C9 WAS .47 μF	3-25-68	R.B.
B5/6G	C	ALL	DELETED WIRE S4 TO E20; ADDED WIRE S4 TO E12	4-18-68	R.B.





QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR CODE	CIRCUIT REF	ITEM NO.

PARTS LIST

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010 ANGLES ± 0° 30'
FRACTIONS ± 1/32

CONTR. NO
DRAWN 12-17-67
CHECK
APPR.
RELEASE DATE

MATERIAL

NEXT ASSY. | FINAL ASSY. | NEXT FINAL ASSY ASSY
APPLICATION | QTY.

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

FINAL ASSY, DC POWER & BALANCE MODULE - SCHEMATIC

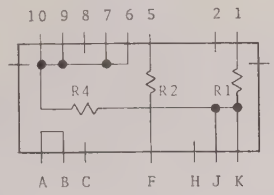
SERIES 1400

SIZE E | CODE IDENT NO 03626 | 14-125

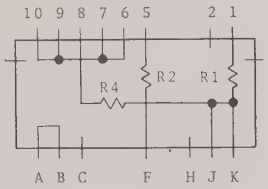
SCALE | WEIGHT | SHEET 2 OF 3

REVISIONS					
ZONE	LTR	EFFECT.	DESCRIPTION	DATE	APPROVED

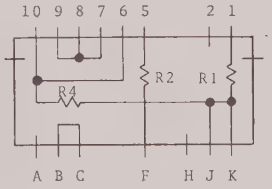
P104-12
1 Arm
2 Wire



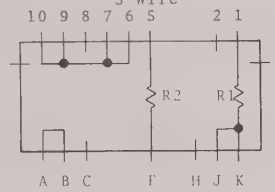
P104-13
1 Arm
3 Wire



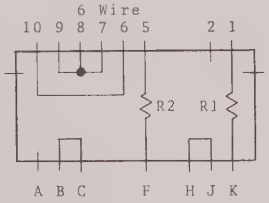
P104-14
1 Arm
4 Wire



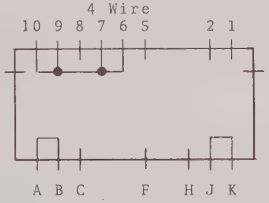
P104-23
Half Bridge
3 Wire



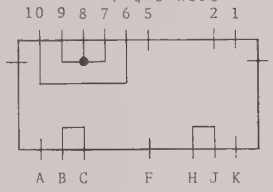
P104-26
Half Bridge
6 Wire

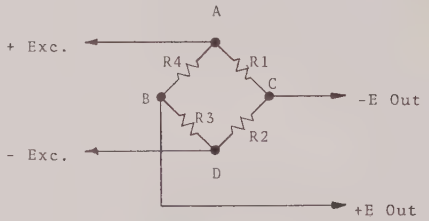


P104-44
Full Bridge
4 Wire



P104-48
Full Bridge
7 & 8 Wire





Per Western Regional
Strain Gage Committee

Notes:

1. Part No. Ident.
   P104-XY
   X = No. of Arms
   Y = No. of Wires

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010 | ANGLES ± 0° 30'
FRACTIONS ± 1/32
MATERIAL

CONTR. NO.		
DRAWN	R.E.F.	1/29/69
CHECK		
APPR	R Brune	1-31-69
RELEASE DATE 1-31-69		

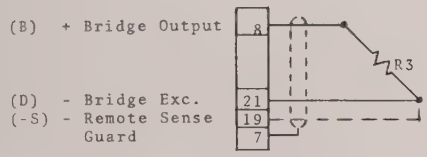
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC
P104 BRIDGE COMPLETION CELLS

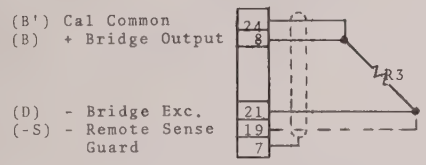
SIZE	CODE IDENT NO.	
B	03626	14-157
SCALE	WEIGHT	SHEET 1

8/66 DIETERICH-POST CLEARPRINT 1000H-10

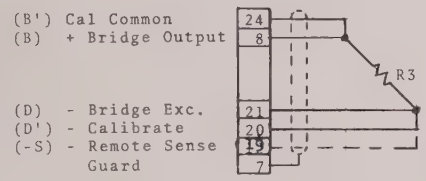
REVISIONS					
ZONE	LTR	EFFECT.	DESCRIPTION	DATE	APPROVED
	A	All	Pin No. 19 of 1 ARM - 4 Wire Was listed as Pin No. 10	9/26/69	J. Rabe



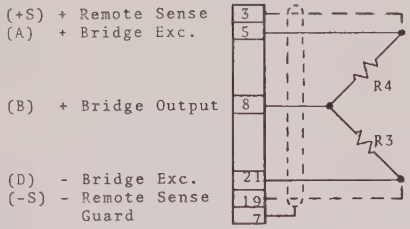
1 ARM - 2 WIRE



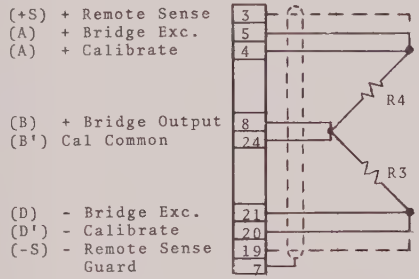
1 ARM - 3 WIRE



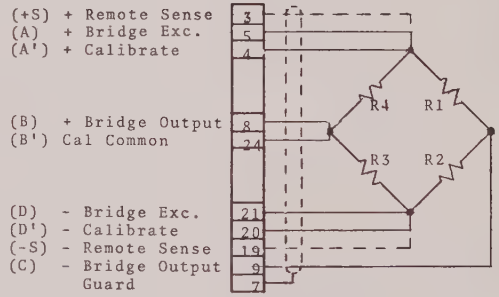
1 ARM - 4 WIRE



HALF BRIDGE - 3 WIRE



HALF BRIDGE - 6 WIRE



FULL BRIDGE 7 WIRE

NOTES:

1. Pin connections shown are 32 pin blue ribbon at rear of module.
2. Pin 24(B') is used for the temperature compensating third wire in the 1 arm - 3 wire input.
3. Dashed lines are sense wires required when remote sensing is used.

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

UNLESS OTHERWISE SPECIFIED			
DIMENSIONS ARE IN INCHES TOLERANCES ON			
DECIMALS ± .010	ANGLES ± 0° 30'		
FRACTIONS ± 1/32			
MATERIAL			

CONTR. NO.		
DRAWN	R.E.T.	1/31/69
CHECK		
APPR	R. Brue	1-31-69
RELEASE DATE 1-31-69		

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

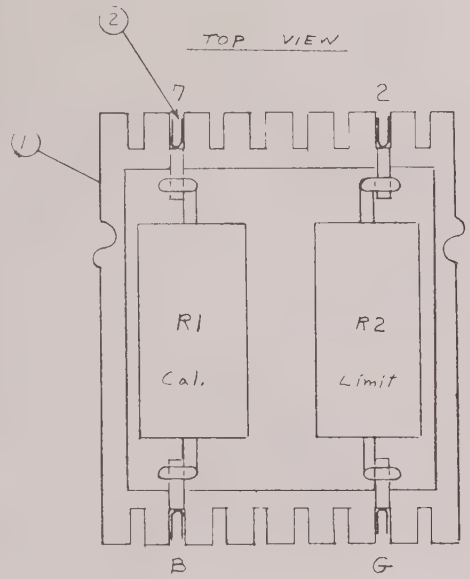
TRANSDUCER BRIDGE CONNECTIONS

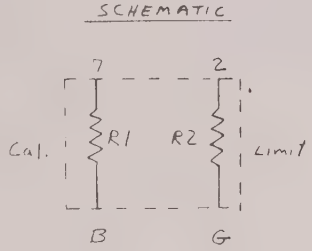
SIZE	CODE IDENT NO.	
B	03626	14-158
SCALE	WEIGHT	SHEET 1

8/66 DIETERICH-POST CLEARPRINT 1000H-10

REVISIONS					
ZONE	LTR	EFFECT	DESCRIPTION	DATE	APPROVED

14-157





IDENTIFICATION NO.:

P202 – XX – YY

XX = Cal. Resistance in Ω

YY = Cal. or Limit Resistance in Ω

QTY	PART NO.	DESCRIPTION	MFR.	CIRCUIT REF.	ITEM
1	14-161	Decal, I.D.			7
1	7010	Resistor, .33W, 1%	01686	R2	6
1	7010	Resistor, .33W, 1%	01686	R1	5
1	14-160	Handle			4
A/R	RTV-11	Silicon Rubber	G.E.	-	3
4	85469-3	Contacts, Mecca	00779		2
1	5-85000-1	Cell, Mecca	00779		1

PARTS LIST

NEXT ASSY.	FINAL ASSY.	NEXT ASSY	FINAL ASSY
APPLICATION		QTY	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
ANGLES ± 0° 30'
FRACTIONS ± 1/32.

MATERIAL

CONTR. NO		
DRAWN	R Bruce	1-22-69
CHECK		
APPR	R Bruce	1-22-69
RELEASE DATE	1-23-69	

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

CALIBRATION CELL

SIZE	CODE IDENT NO.	
B	03626	14-159
SCALE	WEIGHT	SHEET 1 of 1

A 66 DIETERICH POST CLEARPRINT 1000H-10

warranty

It is the continuous effort of Non-Linear Systems, Inc., to design and manufacture its products in such fashion as to at all times achieve the maximum customer satisfaction. Non-Linear Systems, Inc., issues this warranty in full recognition of its continuing obligation to its customers and its desire to always retain their respect and good will.

Non-Linear Systems, Inc., shall correct, either by repair or replacement, defects in material or workmanship in Non-Linear manufactured units or components where such defect develops within one year after delivery of the equipment to the original customer. In the instance of a defect of Sub-assemblies, Assemblies or Instruments manufactured by others than Non-Linear, every effort will be made to assist the customer in obtaining relief from the original manufacturer.

Any instrument claimed to be defective must be returned to Non-Linear Systems, Inc., Del Mar, California, transportation charges prepaid. The instrument will be repaired and returned to the purchaser, transportation prepaid, unless the instrument is found to be damaged by misuse, in which case the instrument will be returned to the purchaser with repair and transportation billed.

This warranty, being the entire agreement between the parties, is given expressly and in place of all other express or implied warranties including implied warranties for merchantability or fitness for particular use.

Non-Linear Systems, Inc.

SHIPPING NOTICE / PACKING SLIP

NOTE: This completed form must accompany shipment.

Date _____

Date of Original Purchase: ___/___ (Mo./Yr.) Your Original P.O. No. _____

CUSTOMER SHIP PRE-PAID TO:

NON-LINEAR SYSTEMS, INC.
533 STEVENS AVE.
SOLANA BEACH, CALIFORNIA 92075

NLS RETURN(FREIGHT PAID)TO:

_____
_____
_____

Attn: _____

- - - - - - - [When using window envelope, fold here.] - - - - - - - - - -

Description of Instrument and Accessories Included:

Instrument Model No. _____ P/N _____ S/N _____

Accessories _____ P/N _____ S/N _____

_____ P/N _____ S/N _____

_____ P/N _____ S/N _____

_____ P/N _____ S/N _____

_____ P/N _____ S/N _____

_____ P/N _____ S/N _____

_____ P/N _____ S/N _____

Reason for Return (specify malfunctions in detail):

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

NLS Form 200-50

SHIPPING NOTICE / PACKING SLIP

NOTE: This completed form must accompany shipment.

Date _____

Date of Original Purchase: ____/____ (Mo. / Yr.) Your Original P.O. No. _____

CUSTOMER SHIP PRE-PAID TO:

NON-LINEAR SYSTEMS, INC.
533 STEVENS AVE.
SOLANA BEACH, CALIFORNIA 92075

NLS RETURN(FREIGHT PAID)TO:

_____

_____

_____

Attn: _____

When using window envelope, fold here.

Description of Instrument and Accessories Included:

Instrument Model No. _____ P/N _____ S/N _____

Accessories _____ P/N _____ S/N _____

_____ P/N _____ S/N _____

_____ P/N _____ S/N _____

_____ P/N _____ S/N _____

_____ P/N _____ S/N _____

_____ P/N _____ S/N _____

_____ P/N _____ S/N _____

Reason for Return (specify malfunctions in detail):

_____

_____

_____

_____

_____

_____

_____

_____

_____

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_____

NLS Form 200-50

NOTICE

If at any time it should become necessary to return an NLS instrument to the factory, follow the instructions contained in the Appendix of this manual (page A-1) and utilize NLS Form No. 200-50 (Shipping Notice/Packing Slip), located at the rear of the manual.

www.manualsplus.com

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